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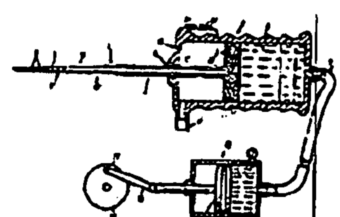
54. Device to suction out and remove fatty deposits in adipose tissue

57. Device for removing and eliminating excess fat from adipose tissue using a cannula 1 capable of subcutaneous penetration with openings 9.9' and 10.10' for sucking out fat. For this purpose, the main duct is linked to a suction unit 14 under reduced pressure. Also, the device is designed so that said cannula has mechanically attached motor components capable of imparting the latter with linear back and forth motion along the axis of said cannula. The motor systems include an external volume pump 15, which uses a tube 7 to transmit pressure changes to the chamber 6 of an internal cylinder in the handle whose piston 5 is kinetically attached at the base of the cannula.



Comment: National Institute of Industrial Property

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The present invention involves a device that can be used, in particular, for plastic surgery allowing for suction removal and evacuation of fat excess and deposits in adipose tissue.

A simple device used for said purpose is already known, allowing fatty excesses to be removed and suctioned out with reduced pressure; said device includes a cannula whose size allows for subcutaneous insertion inside the treated tissue, the cannula being operated using an external handle and the cannula's main duct being connected to a reduced pressure source capable of triggering the gradual suction of the removed systems drawn through the openings located along the external surface of the cannula.

It is clear that handling this component is tricky.

In fact, the surgeon must guide the cannula in order to successively remove and contour the treated area so as to ensure local suction at the cannula's openings; for this purpose, the surgeon runs the cannula, having subcutaneously penetrated the skin from the area where the incision was made into the skin, and imparts a back and forth motion to it, capable of positioning the suction openings located on the cannula surface in view of the excesses in the treated area; at the same time, the surgeon must direct the cannula and move across and into the successive areas in such a way as to fully remove, empty and clear away the largest possible amount of fatty excesses in said area.

Under these conditions, the surgeon must simultaneously control back and forth motion (relatively regular and mechanical) while, both controlling the range and speed of the cannula's movement and directing the latter so as to clear away the target areas.

It is understandable that this task is both physically and mentally tiring, given the need to combine two movements.

The present invention aims at facilitating the surgeon's job by eliminating, in particular, the task of directing the cannula from the relatively regular back and forth motion, consequently giving the surgeon the opportunity to fully concentrate on directional control of the cannula (on the surface and in depth); however, the invention allows the surgeon to remain in control and work, but with a simplified remote control movement, using a back and forth motion, whose frequency and range he or she can control.

According to the invention, the mechanical back and forth motion, while adjustable and controlled by the surgeon, shall use mechanical devices, thus freeing the surgeon from all physical effort by allowing him or her to focus on the directional guidance motion command of the cannula.

For this purpose, the invention involves a device for removing and suctioning out fatty excess from adipose tissue. This device includes a cannula that is capable of subcutaneous penetration and has openings to vacuum out fat, the cannula's main duct connecting, for this purpose, to a reduced pressure suction system. The device is characterized in that

said cannula has mechanically attached motor components capable of providing the latter with linear back and forth motion following the axis of said cannula.

Preferably, the cannula has a graspable handle that the operator can direct. The handle is connected to the empty source in order to vacuum out fat. The cannula is designed to slide at said handle using guidance methods. In addition, the cannula's proximal end is connected to a command component for alternative linear movement.

In a more specific form of operation, the guidance methods include on the one hand, a frontal opening in the handle, in which the proximal half of the cannula moves, and on the other hand, by a motor component for alternative linear movement located inside the handle, which is connected to said end of the cannula.

Preferably, the motor component located inside the handle includes a cylinder containing a removable piston in a chamber designed inside said handle. The chamber is connected to a volume pump capable of triggering the piston's induced movement in said chamber by means of a hydraulic system.

More particularly, the cylinder uses a single action. The piston has an active face, which closes the chamber receiving the hydraulic pressure transmission fluid, connecting to said volume pump through a flexible tube. The opposite side of the cylinder is attached with the proximal end of the cannula. This opposite side closes a vacuum chamber, which is connected to the outside

through a tube connected to said suction source. Said vacuum chamber is thus permanently maintained under reduced pressure, connecting by means of proper openings to the main duct of the cannula having penetrated inside the tissue.

Still more specifically, the cannula's central cylinder chamber is linked with a volume pump through a flexible tube that allows free movement of the handle. The flexible tube is capable of transmitting pressure variations imparted from the pump to the hydraulic fluid.

According to a more specific form of operation, the pump itself has a compression chamber connecting to the handle's interior cannula by said flexible tube, and receiving the action of the piston itself, driven by a back and forth motion from an electric engine with adjustable speed via a connecting-rod system.

Even more specifically, the piston of the volume pump is driven from the electric engine by a connecting-rod raised by an offset hinge on an attached rotation disc of the electric output shaft, designed with adjustable speed. The positioning of the offset hinge of said connecting - rod on the disc is adjustable according to a disc radius between a position that is the closest to the center and one that is the farthest. Said adjustment, like that of the motor rotation speed, allows the frequency and range of the piston's shift in the pump to vary and by that, the frequency and range of the motion incurred at the handle's piston drives the sliding cannula.

The hydraulic pressure transmission fluid has also been designed to include partial compressibility characteristics by providing flexible and regular functioning of the sliding cannula in its alternative linear motion.

According to another characteristic, the device includes a motor speed control and command system, located at the receiving handle of the sliding cannula. Consequently, it is capable of undergoing the operator's finger action. These systems are connected by a remote-control electric circuit to said engine.

According to another development, the offset position of the connecting-rod hinge on the rotation disc of the motor output is movable and adjustable using devices when undergoing the action of a command system located under the handle and to which it is linked by a remote-control system.

Other characteristics and advantages will be presented in the following description, handed over with a specific form of operation presented as a limited illustration, making reference to the attached drawing.

According to the single drawing, we see that the machine is made up of the cannula 1, of which a removable and detachable part, corresponding to the distal end of the cannula 2 placed in the tissue, is raised to a proximal part 3 placed when sliding into the body of the handle 4.

The distal part 2 of the cannula can thus be modified, removed and exchanged depending on the specific characteristics of the subject or the desired treatment.

The proximal part 3 of the cannula is attached to the piston 5, movable in a chamber located inside the handle 4; the back chamber of the piston 6 is the chamber of the central cylinder, in which the piston 5 slides.

The flexible tube 7, with a volume pump 8 described herein, links chamber 6 of the central cylinder.

Within these conditions, the cannula 1 is moved using a sliding motion and along its axis in relation to the handle 4. This sliding motion is directed by the neck 8, used in the frontal face of the handle, in which the proximal part 3 of the cannula moves.

In addition, the piston 5 sliding in the chamber 6 directs the cannula's motion.

Given these conditions, we understand that the movement of the entire cannula 1 along its axis, under the action of the piston 5, allows the alternative back and forth motion of the active part 2 of the cannula placed inside the tissue, thus allowing the successive positioning of openings 9.9', 10.10' in the varied areas of the treated tissues.

The openings 9.9', 10.10' are connected with an internal duct positioned in the body of the cannula, ending at the openings on the proximal part 3. These openings 11.11' in the back part 3 open into the chamber 13 or suction chamber; this chamber is linked by the flexible tube 14 with a suction source, for example a suction pump (not shown).

The flexible tube 7, designed with non-expansive material, in such a way as to completely transmit the pressure variations of the hydraulic fluid that it contains, leads to a volume pump 15; this pump has a compression chamber 16 that is subject to the motion of the piston 17; said piston is linearly movable by the motion of the connecting rod 18, raised by the hinge 19 on the rotation disc 20.

This disc is itself raised on the output shaft of an electric engine (not shown).

The positioning of the hinge 19 along the radius 21 is designed to be adjustable. Preferably, this positioning is controlled through a device such as an electric or pneumatic actuator. This is designed in such a way as to allow remote-control adjustment of the offset positioning of the hinge 19, as will be described further on.

We understand that given these conditions, the motor's rotation leads to the alternative linear motion of the piston 17 of the pump 15 with a pressure variation in the fluid, located in the chamber 16. This variation is transmitted and shifted by the flexible tube 7 in the chamber 6 to the inside of the handle 4; the hydraulic pressure pulses transmitted trigger the alternative linear motion of the piston 5 in the handle 4. The movements incurred by the corresponding motion of the piston 17 in the pump 15, in phase reversal with the latter.

From then on, starting the engine produces, depending on the adjustable speed and the surgeon's adjustment, movement of the piston 5 in the handle and consequently, the alternative linear movement along the axis of the sliding cannula 2.

From that point on, the surgeon has a tool in his or her hand, with a cannula that undergoes an alternative back and forth motion; the surgeon is free from mechanical work, aiming to impart his regular and alternative movement to the cannula; in addition, the surgeon, physically freed from this task, can devote himself or herself, much more safely and intensely, to directional control of the cannula.

In addition, as one can see in the drawings, the surgeon has, on the handle, two command systems that can be operated. For example, each can be operated in the form of a notched, rotating wheel, each one for example, driving a potentiometer, the potentiometer adjusting one of the motor rotation speed, the other, the linear motion of the positioning of the offset hinge of the connecting rod in relation to its motor disc.

From then on, the surgeon, while totally free from mechanical motion needed to be imparted to the cannula, can however, constantly control this movement, in frequency and range alike. All he or she must do is use the quick and controlled action of a finger on the wheels to prompt the variations deemed necessary in the range or frequency of the movement of the cannula.

We can design many variants and adaptations to the diagram, described herein and illustrated in the form of a drawing.

Hence, we can introduce into the whole engine, i.e., in the two, engine and receiver chambers respectively, of the pump and cylinder located in the handle, a pressure transmission hydraulic fluid designed with partial compressibility characteristics (e.g., oil/gas stabilized emulsion) thus providing

flexible functioning of the alternative motion of the sliding cannula.

The outside surfaces of the handle 4 could be designed with any appropriate form, capable of being controlled by the operator and having an ergonomic grip.

A pressure indicator could be designed on the hydraulic system, either for the pump or the handle to provide the operator with better control.

Some hydraulic fluid draining devices are also designed, preferably on the entire system, in such a way as to allow draining and regular removal of the hydraulic fluid of the pressure transmission, the latter preferably being sterilized between two operations so as to avoid any risk of contamination between patients.

According to a variant, the chamber 13 could be used to receive an anesthetizing liquid; this liquid could be introduced into the chamber from the openings 9.9', etc. of the cannula having previously undergone a suction stage; however, the anesthetizing liquid could also be introduced into the chamber 13 from the outside by an opening designed for this purpose on the inner surface of the handle; in this case, after having plugged the opening of the pipe 14 in the chamber 13, by installing a proper valve (not shown), the movement of the piston 5 should trigger the forcing back of the anesthetizing liquid by the openings, 9.9', 10.10' of the cannula; this variant allows, as a consequence, during the initial phase, to trigger, with the same component used to suction out fat, the local anesthetic in the precise area that will be cleared out using this component.

CLAIMS

1 – Device for removing and eliminating excess fat from adipose tissue, having a cannula (1) capable of subcutaneously penetrating with openings (9.9', 10.10') to suction fat out, the central duct of the cannula being connected for this purpose to a drainage system (14) under reduced pressure, characterized in that said cannula is assembled mechanically attached to the motor systems, suited to impart, to the latter, a back and forth linear movement along the axis of said cannula.

2 – Device of Claim 1, characterized in that the cannula (1) is supported by a grip handle (4), used by the operator, and linked to the empty source to suction out fat, the cannula being made to slide, in relation to said handle, by guiding the proximal end (3) of the cannula, which is, in addition, connected to an alternative, linear motion command system.

3 – Device of Claim 2, characterized in that the guidance consists on the one hand, of a frontal opening (8) directed at the handle (4), in which the proximal half (3) of the cannula (1) is moved, and on the other hand, of an alternative, linear motion motor system located inside the handle to which said cannula end is connected.

4 – Device of Claim 3, characterized in that the motor system located inside the handle (4) consists of a cylinder that has a movable piston (5) in a chamber (6) designed inside the handle (4), the chamber being connected by a hydraulic system (7) to a volume pump (15) capable of triggering the piston movement incurred in said chamber.

5 – Device of Claim 2 or Claim 3 or Claim 4, characterized in that the cylinder in the handle (4) has a simple purpose and the piston (5) has an active face that closes the chamber (6) receiving the hydraulic pressure transmission fluid, connected to said pump (15) by a flexible tube (7), the opposite side of the piston being attached to the proximal end (3) of the cannula (1); this opposite side closes one suction chamber (13) connected to the outside by a tube (14) connected to said suction source; said suction chamber is thus permanently maintained under reduced pressure, connected by proper openings, with the central pipe of the cannula having penetrated inside the tissue.

6 – Device of any of Claims 1 to 5, characterized in that the chamber (6) of the central cylinder of the cannula is linked with a volume pump (15) through a flexible tube (7) capable of transmitting pressure variations imparted from the pump to the hydraulic fluid.

7 – Device of any of Claims 1 to 6, characterized in that the pump (15) is itself made up of a compression chamber (16) connected

to the interior cylinder of the handle by said flexible tube (7), and receives piston movement (17) itself driven in a back and forth motion from an electric engine with adjustable speed by a connecting rod system (18).

8 – Device of any of Claims 1 to 7, characterized in that the drive of the piston (17) of the volume pump (15) from the electric engine occurs using a connecting rod (18) raised by an offset hinge on a rotation disc (20) attached with the electric engine output shaft, designed with adjustable speed, the positioning of the offset hinge of said connecting rod on the disc being adjustable along the disc radius between the position closest to the center and the farthest position, said adjustment, like the adjustment of the motor's rotation speed to vary the frequency and range of the piston's motion in the pump and by that, the frequency and range of the motion incurred at the piston of the handle driving the sliding cannula.

9 – Device of any of Claims 1 to 8, characterized in that the fluid transmission of this hydraulic pressure is designed with partial compressibility characteristics, providing flexible and regular functioning of the sliding cannula in its alternative linear motion.

10 – Device of any of Claims 1 to 9, characterized in that the device has motor speed control and command systems located at the receiving handle of the sliding cannula and therefore, capable of undergoing the operator's digital action, these systems being connected by a remote-control electric circuit to said motor.

11 – Device of any of Claims 1 to 10, characterized in that the offset position of the hinge of the connecting rod on the rotation disc of the motor's output, is movable and adjustable using mechanical means undergoing the action of a command system located under the handle and to which it is linked by a remote-control system.